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HOSPITAL TECHNICAL MEMORANDUM

FACSIMILE TELEGRAPHY: THE TRANSMISSION OF PATHOLOGY REPORTS WITHIN A HOSPITAL—

A CASE STUDY

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Facsimile Telegraphy: The Transmission of Pathology Reports within a Hospital — A Case Study

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I. Introduction

1. The National Health Service Central O and M unit assisted the Camberwell Hospitals Management Committee and the King's College Hospital Board of Governors with the conduct and evaluation of two field trials designed to test the suitability of Facsimile Telegraphy (F/T) equipment for the transmission of pathology reports between laboratory and wards. This report gives full details of these trials and the conclusions which appear to emerge. The data collected during these trials has also been used, with the permission of the hospital authorities concerned, in the general study undertaken by this unit into the possible uses of F/T for internal communication purposes in hospitals, published as Technical Memorandum No. 18, Facsimile Telegraphy: Possible Applications in District General Hospitals. The courtesy and co-operation received from the authorities' officers and the manufacturers' representatives during the trials are gratefully acknowledged.

Aims of the trials

2. The trials were designed to determine:

(1) The extent to which the use of F/T equipment in place of the hospitals' messenger services for transmitting pathology reports between the laboratories and wards, enabled clinicians to take earlier action on them and facilitated the notification of reports regarded as urgent.

(2) The advantages which clinicians found accrued to the patients when earlier action was taken.

(3) The ability of the present messenger services to provide the services required.

(4) The effect on the results produced by the trials if hourly messenger services had operated throughout in place of the existing services.

II. F/T equipment used for the trials

3. A two-part request/report form originated on the wards was in use in the hospitals at which the trials were conducted. It was therefore appropriate to use F/T equipment designed for the transmission of prepared documents rather than that for manuscript communication, in which the transmitted document is originated on continuous stationery in the transmitter.

4. The equipment used will transmit the whole or any selected part of prepared documents or drawings in typed, printed or manuscript form. The legibility of the facsimile copies produced is satisfactory at least down to 8-point type size, and it is claimed they are usable immediately and will not fade. Switching can be provided to enable a receiver to be fed by any one of a number of transmitters or to enable a transmitter to feed a number of receivers either singly, simultaneously or in any required groupings. Models with transmission times varying between 15 and 27 seconds per inch of copy are available with a maximum copy depth of $13\frac{3}{4}$ in. and width of $8\frac{3}{8}$ in. At the highest speed available, therefore, transmission of a foolscap size document would take 3 minutes $26\frac{1}{4}$ seconds and at the lowest speed 9 minutes 10 seconds. It is understood the highest speed equipment can only be used with private lines of not more than about 5 miles in length. Above this distance and on all G.P.O. public lines satisfactory facsimiles cannot normally be produced unless the transmission speed is restricted to 22·5 seconds per inch of copy. Within the periphery of a hospital the internal telephone lines could be used, although if this resulted in significant interference with the normal telephone traffic it would probably be preferable to install additional lines for the F/T transmission.

5. A document to be transmitted is wrapped around a drum in the transmitter. During transmission the drum is rotated and a photo-electric scanning device is slowly traversed in a direction parallel to the drum's axis so that the whole document is scanned in the form of a close spiral. The movements of the roll of special recording paper and the writing head in the receiver are synchronised with the movements of the scanning unit and drum respectively in the transmitter. This causes the writing head to which the modulated signals from the transmitter are fed, to traverse the paper in a series of adjacent parallel lines, each corresponding to a scanning line around the transmitter drum, and to build up a facsimile image of the original document. Transmission is always initiated and controlled from the transmitter and there is no need for the receiver to be staffed. Once switched on the receiver is completely automatic and sends a " satisfactory reception " signal back to the transmitter when transmission is completed before reverting to standby. An audible " end of message " alarm is also provided at both transmitter and receiver to indicate when transmission has been completed.

6. The following table shows the current prices quoted for this type of equipment:

Item	*Purchase price* (£)	*Annual rental** (£)
Transmitter	898	240
Receiver	756	210
Paper rolls for receiver (200 ft. × 9 in. each) per dozen ..	18	—

* Minimum term of five years.

III. Scope and conduct of the trials

7. Both trials took place between two wards and the pathology laboratory responsible for testing and reporting on their specimens and lasted for consecutive periods of 21 and 27 days respectively. In one case the laboratory and wards chosen were in the same hospital and in the other, although they were in different hospitals, the distance separating them was only about 500 yards. During the trials the hospitals' messenger services continued to deliver requests and specimens from the wards to the laboratories and to return completed reports to the wards in the usual way. Before they were returned by messenger, however, copies of the reports were transmitted from the laboratories to the wards by F/T equipment. This was done in both trials by connecting a transmitter installed in the pathology laboratory to a receiver at the nurses' station on one of the two wards selected. Facsimile copies of reports for the other wards in the trials were delivered by nursing staff as soon after receipt at the nurses' stations as possible. Although equipment providing the highest possible transmission speed was not used for the trials, this had no appreciable effect on the results because the number of reports involved was not large enough to make transmission time a significant factor. The times the request and report forms (both copies) reached the various stages in their progress from the wards to the laboratories and back again were recorded to provide the following information:

(1) To what extent and how much sooner copies of reports transmitted by F/T equipment reached the wards before those delivered by messenger.

(2) The extent to which clinicians were present in the wards to take advantage of earlier delivery of reports by F/T transmission.

(3) The times taken for the several main stages in the progress of request/report forms.

In addition clinicians were asked to classify the action taken on all reports under one of six agreed headings, so that in those cases where they found it possible to take earlier action on the copies transmitted by F/T, they could assess the effect on patients' treatment. Full details of the two trials are set out in Appendices A and B.

IV. Results of the trials

8. The principal results produced by the trials are summarised below:

(1) In all cases the F/T copies of reports reached the wards before the copies delivered by messenger, but in only 34·7% and 61·8% of cases respectively did the clinicians actually take action on the F/T copies before the arrival of those delivered by messenger. (*See para.* 5 *of Appendix A and para.* 7 *of Appendix B.*)

(2) Had the messenger services worked strictly to existing schedules throughout the trials and assuming some small adjustments to delivery times, a reduction of the figures shown under (1) to 17·4% and 8·1% respectively would have resulted. (*See para.* 10 *of Appendix A and para.* 12 *of Appendix B.*)

(3) A further reduction to 16·2% and 4% respectively would have resulted if the messenger services operated during the trials had provided hourly deliveries of reports between laboratories and wards. (*See para.* 14 *of Appendix A and para.* 16 *of Appendix B.*)

(4) Included in the percentages shown under (3) were a number of reports which resulted in no change in treatment, leaving residues of 3·6% and 2·4% respectively of reports which led either to a change of treatment or the immediate initiation of a further stage of investigation. These residues therefore represent the extent to which substituting F/T transmission of pathology reports for delivery by an hourly messenger service would have enabled the clinicians concerned to initiate the next treatment or diagnostic stage sooner. (*See para.* 15 *of Appendix A and para.* 17 *of Appendix B.*) It is recognised, of course, that a patient may benefit indirectly from the earlier appraisal of reports which result in no immediate change of treatment. Such reports may enable the clinician to exclude certain possibilities and could, therefore, result in a more definite diagnosis earlier.

(5) It did not necessarily follow that the few patients comprising these small residues all benefited because earlier initiation of the next stage of clinical action was possible. The clinicians responsible, therefore, subsequently reviewed the relative case notes to eliminate these where they considered the action taken on the reports had produced no identifiable benefit. This left final percentages of nought and 2·4 respectively of cases in which the clinicians were able to show that some benefit had accrued to the patients from the action taken. Each of the three patients comprising the 2·4% was prescribed a change of drug but in only one case was it actually given on the same day as the clinician saw the F/T copy of the report. (*See para.* 16 *of Appendix A and para.* 18 *of Appendix B.*)

(6) As a means of transmitting reports regarded as requiring urgent notification to the wards, F/T transmission was faster than messenger delivery—although this would not be so if the distance involved was very small—and marginally slower than telephone because of the transmission time factor connected with F/T equipment. Compared with telephone and messenger delivery, F/T transmission had the disadvantage that the sender could not know if there was anyone present

at the receiver competent to act on reports sent. On the other hand it did provide facsimile copies which must generally be considered less liable to misinterpretation than a telephoned message. At the hospitals visited during the study the need was apparently being adequately met by notifying urgent reports to clinicians by telephone, followed later by the written reports. In any case the number of reports needing urgent notification during the trials was very small indeed, probably 5% or less of all those received. The pathologist and biochemist associated with the trials confirmed that this was a normal average for the two laboratories concerned. Other pathologists in the Hospital Service were asked to indicate the normal percentage of urgent reports dealt with in their laboratories and gave even lower figures, in a few cases only 1%. (*See para.* 8 *of Appendix A and para.* 10 *of Appendix B.*)

(7) Relatively lengthy periods of time frequently elapsed during the various stages in the progress of the request/report forms studied during the trials. Expediting the return of reports in a hospital by using F/T transmission rather than an hourly messenger service would normally only shorten by minutes one stage of a procedure which occupies at least a number of hours and is generally measured in days. (*See para.* 15 *of Appendix A, para.* 17 *of Appendix B, Tables A–D of Annexe A, Appendix A, and Tables A–F of Annexe C, Appendix B.*)

(8) Although both trials were limited to returning the completed pathology reports to only two wards, it was apparent that the time taken for F/T transmission would produce a significant delay if all the reports for a large hospital were dealt with in this way (see paragraph 9 below).

V. Evaluation of the trials

9. Transmission time by F/T was not a significant factor in the trials because of the small number of reports involved. However, if F/T equipment were used, for example, in a hospital of 20 wards where an average of 175 in-patient requests were received each week-day, this factor would assume far greater importance. If each report was one-third foolscap size, the total week-day transmission time using the highest speed equipment available would be about 3 hours 45 minutes which includes an allowance of 20 minutes for loading and unloading the transmitter. Unless a reasonably smooth flow of completed reports could be achieved—not an easily attainable pattern in pathology laboratories—even the small time advantages revealed by the trials could be lost, resulting in F/T copies reaching the wards after the delivery times an hourly messenger service could achieve. Delay due to transmission time could, of course, be reduced by providing an additional transmitter in the laboratory.

10. On the other hand, in any routine messenger round-trip service there is an inherent delay which is very small for the first point visited but increases progressively as a round proceeds. Delays from this cause can be reduced by arranging for the points in the round to be visited in an optimum order.

11. The total annual revenue cost of completely equipping a pathology laboratory and 20 wards with F/T equipment for the transmission and reception respectively of pathology reports would be about £2,847. The addition of a second transmitter in the laboratory would increase this cost by about £141. Sharing one receiver between two wards, assuming the hospital layout made such an arrangement feasible, would reduce the cost to about £1,568 per annum. The cost of a special messenger service to link laboratory and wards in a hospital of this size and providing, say, nine hourly deliveries between 9 a.m. and 5 p.m. on week-days and four between 9 a.m. and noon on Saturdays would be about £883 per annum. This assumes a time allowance of 2½ minutes for each point visited which is based on timings taken during the trials, and an annual cost of £824 for a full-time Class 1 porter. The computation of the costs quoted in this paragraph is set out in Appendix C.

12. Direct comparison between the cost of F/T equipment and a special messenger service for the return of pathology reports to wards is not generally valid because it assumes that a separate service would be provided for this purpose, whereas in practice this would normally be one of the functions of a comprehensive routine service covering all wards and departments. Where a messenger service on these lines was operating, no appreciable saving on its cost could be expected to follow the introduction of F/T transmission of pathology reports unless it enabled a significant reduction to be made in the number of ward visits made. Any savings achieved would inevitably be small in comparison with the cost of providing F/T equipment and appreciably less than the cost quoted in paragraph 11 for a separate messenger service.

13. Apart from providing for the transmission of pathology reports to wards, the use of F/T equipment would enable the originals to be retained as the laboratory copies so that existing procedure for obtaining duplicates could be dispensed with. Either photocopying, interleaved carbon or NCR paper (No Carbon Required) are methods commonly employed at present for this purpose. The use of interleaved carbon or NCR paper has the advantage that the preparation of duplicate copies as a separate process is eliminated and reports are available for distribution to wards immediately after signature by the pathologist. With photocopying, reports are duplicated after signature by the pathologist, so that distribution is inevitably delayed by the time

taken for this process. The time taken daily to copy an average of 175 reports using Xerographic equipment, including the ancillary tasks of preparation, guillotining and clearing away, would be about 28 minutes.* The annual cost of reproducing this number of reports by Xerography would be about £275 and this sum would be saved if F/T equipment was introduced at a hospital using this method of duplication. Corresponding but smaller savings would be made where interleaved carbon or NCR paper was in use.

Conclusions as to suitability

14. The trials have shown that the use of F/T equipment in place of an effective messenger service for the return of pathology reports to the wards, although costing substantially more, provides no more than a tenuous benefit to patients. The transmission time factor could eliminate the smaller benefits identified during the trials and, if used in a laboratory handling a substantial number of reports, could result in slower rather than quicker reporting to wards in some cases. The small and rather uncertain advantages accruing do not appear sufficient to justify the additional expense of providing F/T equipment for pathology report transmission between the laboratory and wards in hospitals.

15. It was not within the terms of reference of this study to consider transmission arrangements for document traffic between hospitals. It seems likely, however, that a better case might exist for the use of this equipment for transmitting pathology reports between hospitals where laboratory facilities have been centralised. In such an application the equipment requirements and therefore the cost would be very much less—one transmitter and one receiver would normally suffice—and the opportunity to save time would be enhanced because alternative delivery arrangements by van/messenger would generally be less frequent than hourly.

*Abstract of Efficiency Studies in the Hospital Service No. 72, Pathology Department (H.M.S.O., price 8d. each).

Appendix A

(paragraph 7)

Trial of F/T equipment for transmitting pathology reports between laboratory and wards at St. Giles' Hospital, S.E.5

Conduct of trial

1. The trial took place between the laboratory and wards C4 and D4 which are 24-bed and 21-bed female and male medical wards respectively situated on the third floor of a ward block about 100 yards away. All requests received from the two selected wards by the St. Giles' Hospital pathology laboratory—other than the few passed to Dulwich Hospital to be tested there—during the period 31st August to 26th September, 1964 (both dates inclusive), were included in the trial. Requests and specimens were conveyed between the wards and the laboratory by the messenger service in the usual way. A F/T transmitter was installed in the laboratory office and connected to a single receiver at the nurses' station on the male medical ward. Although reports were still returned by the messenger service during the trial, further copies of all reports for C4 and D4 were also sent by F/T as soon as they became available. The F/T copies for the female medical ward were taken to that ward by nursing staff on the male ward as soon after receipt as possible.

2. The messenger service operated in the hospital was scheduled to make the following daily visits to the pathology laboratory and the wards (Sundays excepted and finishing at noon on Saturdays) during the period of the trial:

8.30 a.m. 10.30 a.m. 1 p.m. 3.30 p.m.	Collect completed reports from laboratory and deliver to wards.
9.15 a.m. 11.15 a.m. 2 p.m.	Collect requests and specimens from wards and deliver to laboratory.

3. Arrangements were made to record the following times in connection with the movement of request/report forms and the F/T copies:

(1) When request/report forms were available for collection in the wards by the hospital's messenger service (recorded by nursing staff).

(2) When request/report forms reached the laboratory (recorded by laboratory clerk).

(3) When the F/T copies of reports reached the wards (recorded by laboratory clerk).

(4) When the F/T copies were seen by the clinicians (recorded by clinician).

(5) When the copies of reports delivered by messenger service reached the wards (recorded by nursing staff).

A record was also kept by the laboratory clerk of the times of deliveries to and collections from the laboratory by the hospital's messenger service.

4. The clinicians responsible were asked to classify the action taken on reports under one of the following headings which had been previously agreed:

(i) continue treatment unchanged;
(ii) change treatment;
(iii) further investigation;
(iv) discharge patient;
(v) urgent reference to consultant or registrar;
(vi) reference to consultant next visit.

Data provided by trial

5. The number of request/report forms originated in the two wards during the trial and other relevant data are out below:

Total number of requests (haematology 99, bacteriology 99, and chemical-pathology 133) ..	331
Number of request/reports where all the data required for the trial were obtained	277
Number of cases where reports delivered by messenger arrived on wards after action had been taken by clinician on F/T copies	96 (34·7%)
Number of cases where reports delivered by messenger arrived on wards before action had been taken by clinician on F/T copies	181 (65·3%)
Average time delay between clinician acting on reports on which earlier action was possible and corresponding copies delivered by messenger service arriving on wards	11 hr 58 min.

6. The following action was taken by the clinicians on the 277 reports for which all the required data were obtained, and on the 96 of these which were acted on before the copies delivered by messenger service arrived:

Action by clinician	" 277 *reports* "	" 96 *reports* "
Continue treatment as before	231	80
Change treatment	26	6
Further investigation	14	5
Discharge patient	—	—
Urgent reference to consultant or registrar	4	4
Reference to consultant next visit	2	1

7. Tables showing the times that elapsed during the passage of the request/report forms through the main stages of the procedure appear in Annexe A. The flow chart in Annexe B shows the procedure for dealing with request/report forms followed during the trial and the procedure normally followed. It also identifies the tables in Annexe A with the part of the procedure to which they refer.

8. During the trial the clinicians asked for 12 of the 331 requests made to be dealt with urgently. The normal practice in such cases is to notify the results either by telephone or special messenger, but this arrangement was suspended during the trial because of the availability of the F/T equipment which provided a comparable service. A record of reports considered by the laboratory staff to require urgent notification to the wards because the results of the tests revealed unusual or unexpected features was not kept.

9. During the period of the study the messenger service between the laboratory and the wards provided the following collections and deliveries:

Number of mornings when full service, as scheduled, was provided	17
Number of mornings when one visit to laboratory was omitted	6
Number of mornings when two visits to laboratory were omitted	1
Number of afternoons when full service, as scheduled, was provided	17
Number of afternoons when one visit to laboratory was omitted	2
Number of afternoons when two visits to laboratory were omitted	1

Evaluation of data

10. The times of collections and deliveries by the messenger service and the failure to make all those scheduled, influenced the results of the trial. This is demonstrated by the following further classification of the 96 reports where the copy delivered by messenger arrived after the clinician had seen the F/T copy:

(1) Twenty-three of these reports became available for distribution to wards from the laboratory after the last collection by the messenger service at 3.30 p.m. and before 5 p.m. These were normally returned by the first collection the next morning. A later daily collection would have reduced the number of these reports which resulted in earlier action by using the F/T copy, e.g. a daily collection at 4.30 p.m. would have reduced this number by seven " continue treatment as before " cases.

(2) A further nine reports were transmitted from the laboratory by F/T but the copies for delivery by messenger, although they must have been available, were not taken with the next collection. Had they been, the corresponding copies sent by F/T would not have resulted in earlier action by the clinician. The nine reports concerned were seven " continue treatment as before " cases, one " further investigation " case and one " urgent reference to consultant " case.

(3) Another 16 reports were delayed because the messenger service failed to make all the scheduled collections from the laboratory. Had these omissions not occurred the corresponding copies sent by F/T would not have resulted in earlier action by the clinician. The 16 reports concerned were 11 " continuous treatment as before " cases, 3 " change treatment " cases and 2 " further investigation " cases.

(4) The F/T copies of the other 48 of these reports, representing 17·4% of the total number for which full data was obtained, produced earlier action because they reached the wards just prior to, or during, the clinician's visit. The average time of arrival on the wards of the copies of these reports delivered by messenger was 2 hours 43 minutes after the F/T copies.

11. Examination of the dates, where quoted, on which clinicians originated requests during the study showed that in only 94 cases were the associated specimens collected on the same day. In 129 cases requests were made the day before the specimens were collected and in 14, 25 and 3 cases the lapsed time was 2, 3 and 4 days respectively. Periods greater than this were recorded for five other requests. In most cases, of course, it is likely that there would be clinical reasons for these time lapses between the origination of requests and the collection of specimens.

12. Although the complete movement times for the F/T and manually delivered copies of the urgent reports were not recorded, it can be assumed that the former copies would have reached the ward before the latter. It does not necessarily follow, of course, that the F/T copies would have been acted upon before the arrival of the latter.

Summary of results

13. The principal results produced by the trial are summarised below:

	Paragraph or Table (this Appendix)
(1) The use of F/T equipment made earlier action by clinicians possible on 96 of the 277 reports originated during the trial for which all the data required as obtained.	5
(2) On 80 of these 96 reports the clinicians either continued treatment as before or decided to refer to the consultant responsible next visit, so that in only 16 cases did earlier notification result either in a change of treatment, further investigation or urgent reference to consultant or registrar.	6
(3) The messenger service failed to provide all the collections scheduled, and reports for delivery by this service were not always included in the collection immediately following transmission by F/T. Had these omissions not occurred the number of reports on which earlier action by clinicians was possible would have been reduced by 25 to 71 (18 " continue treatment as before " cases, 3 " change treatment " cases, 3 " further investigation " cases and 1 " urgent reference to consultant " case).	9 10 (2) 10 (3)
(4) The return of some reports was delayed because the last collection from the laboratory by the messenger service was made at 3.30 p.m. each week-day. During the trial 23 of the 96 reports on which earlier action was taken by clinicians were delayed in this way. A later week-day collection would have resulted in some of these reports not falling into this category, e.g. a daily collection at 4.30 p.m. would have reduced the number by seven " continue treatment as before " cases.	10 (1)
(5) In those 48 cases where earlier action was taken by clinicians and where the contingencies referred to in sub-paragraphs 10 (1), (2) and (3) did not apply, an average delay of 2 hours 43 minutes occurred between the arrival in the wards of the F/T copies and the copies delivered by messenger.	10 (4)
(6) In most cases (176 out of 270) requests were not received in the laboratory on the day they were originated. Delays of up to three days were common and a few in excess of this were recorded.	11
(7) The time that elapsed between request/report forms and specimens being available for collection on the wards and their delivery to the laboratory exceeded 3 hours in only 4·6% of cases recorded.	Table A of Annexe A
(8) The time that elapsed between the arrival of request/report forms at the laboratory and the transmission of completed reports by F/T equipment to Ward D4 was less than 78 hours for 95·8% of the specimens tested. The remainder were completed in periods varying between 90 and 174 hours.	Table B of Annexe A
(9) The time that elapsed between the arrival on the wards of the F/T copies of reports and those delivered by messenger was less than 2 hours in 51·9% of the cases, between 2 and 4 hours in 19·6%, between 4 and 18 hours in 22·1% and between 19 and 70 hours in the remaining 6·4%.	Table C of Annexe A
(10) The time that elapsed between the arrival on the wards of the F/T copies of reports and action being taken upon them by the clinicians was less than 2 hours in 40·1% of the cases, between 2 and 4 hours in 22·7%, between 4 and 20 hours in 24·6% and between 20 and 49 hours in the remaining 12·6%.	Table D of Annexe A

Effect of substituting an hourly messenger service

14. If an hourly messenger service had been operated during the period of the trial with collections of completed reports from the pathology laboratory, say, at 9 a.m. and at hourly intervals thereafter until 5 p.m. on week-days and until noon on Saturdays, the result would have been a reduction in the number of cases where earlier action by clinicians on F/T copies was possible from 96 (34·7%) to 45 (16·2%) with action taken as follows:

Continue treatment as before	35
Change treatment	6
Further investigation	1
Urgent reference to consultant or registrar	3

APPENDIX A (contd.)

In making this assessment an average journey time of 10 minutes between the laboratory and wards C4 and D4 has been assumed which is the average time recorded for this journey during the trial.

15. The following table provides a detailed analysis of the 10 reports (3·6%) referred to in paragraph 14 which resulted in action by clinicians other than continuing with treatment as before:

Patient	*Ward*	*Action taken by clinician*	*Time F/T copies of reports acted upon by clinicians*		*Notional time of return by hourly messenger service*		*Delay between F/T copies being acted upon and notional time of return by hourly messenger service*
			Time	*Date*	*Time*	*Date*	
Patient A	D4	Urgent reference to consultant	11 a.m.	8 9 64	11.10 a.m.	8 9 64	10 minutes
Patient A	D4		11 a.m.	8 9 64	11.10 a.m.	8 9 64	10 minutes
Patient B	D4		3 p.m.	9 9 64	3.10 p.m.	9 9 64	10 minutes
Patient A	D4	Further investigation	3 p.m.	9 9 64	3.10 p.m.	9 9 64	10 minutes
Patient C	D4	Change treatment	3 p.m.	9 9 64	3.10 p.m.	9 9 64	10 minutes
Patient D	D4	Change treatment	3 p.m.	9 9 64	3.10 p.m.	9 9 64	10 minutes
Patient E	D4	Change treatment	Noon	11 9 64	12.10 p.m.	11 9 64	10 minutes
Patient F	D4	Change treatment	11 a.m.	12 9 64	11.10 a.m.	12 9 64	10 minutes
Patient G	C4	Change treatment	11 a.m.	12 9 64	11.10 a.m.	12 9 64	10 minutes
Patient H	C4	Change treatment	10.15 a.m.	17 9 64	11.10 a.m.	17 9 64	55 minutes

16. It was subsequently learned from the clinician concerned that five of the eight patients mentioned in paragraph 15 died in hospital and that in the other three cases there was no evidence that they benefited because earlier action on the pathology reports was possible.

Annexe A

(paragraph 7 of Appendix A)

TABLE A

Time that elapsed between request/report forms and specimens becoming available for collection on the wards and their arrival at the pathology laboratory

Elapsed time in hours	*Number of request/report forms and specimens*
0–1	113
1–2	100
2–3	55
3–4	5
4–5	3
5–6	—
6–7	3
15–16	1
17–18	1

TABLE B

Time that elapsed between the arrival of request/report forms at the pathology laboratory and the transmission of the completed reports to the wards by facsimile telegraphy equipment

Elapsed time in hours	*Number of reports*	*Type of test (Note 1)*		
		Bacteriology	*Chemical pathology*	*Haematology*
0–6	45	11	16	18
6–12	22	8	9	5
12–18	—	—	—	—
18–24	48	6	17	25
24–30	75	19	32	24
30–36	1	1	—	—
36–42	—	—	—	—
42–48	12	7 (1)	2	3
48–54	48	24 (8)	15 (6)	9 (8)
54–60	—	—	—	—
60–66	—	—	—	—
66–72	8	4 (4)	3 (1)	1 (1)
72–78	11	3 (1)	6 (4)	2 (2)
78–84	—	—	—	—
84–90	—	—	—	—
90–96	3	—	3 (3)	—
96–102	6	1 (1)	5 (3)	—
138–144	1	—	1 (1)	—
168–174	2	1 (1)	1 (1)	—

Note 1: Only emergency requests were dealt with in the pathology laboratory during the Saturday afternoons and Sundays of the trial period. The numbers of reports where the elapsed times included a week-end period are shown in brackets.

TABLE C

Time that elapsed between the facsimile telegraphy copies of reports and the copies delivered by the hospital's messenger service being received on the wards

Elapsed time in hours	*Number of reports*
0–1	67
1–2	79
2–3	37
3–4	18
4–5	1
5–6	1
15–16	11*
16–17	17*
17–18	32*
18–19	6*
19–20	3*
20–21	—
21–22	1*
22–23	1*
23–24	1*
43–44	1†
44–45	1†
45–46	1†
46–47	—
47–48	—
48–49	1†
69–70	2‡

* These reports became available for return by the messenger service after the last daily collection and were not returned to the wards until the following morning.

† These reports became available for return by the messenger service after the last collection on Saturday and were not returned to the wards until the following Monday.

‡ These reports became available for return by the messenger service after the last collection on Friday; were not collected the next day and were not, therefore, returned to the wards until the following Monday.

TABLE D

Time that elapsed between facsimile telegraphy copies of reports being received on the wards and action taken on them by the clinician

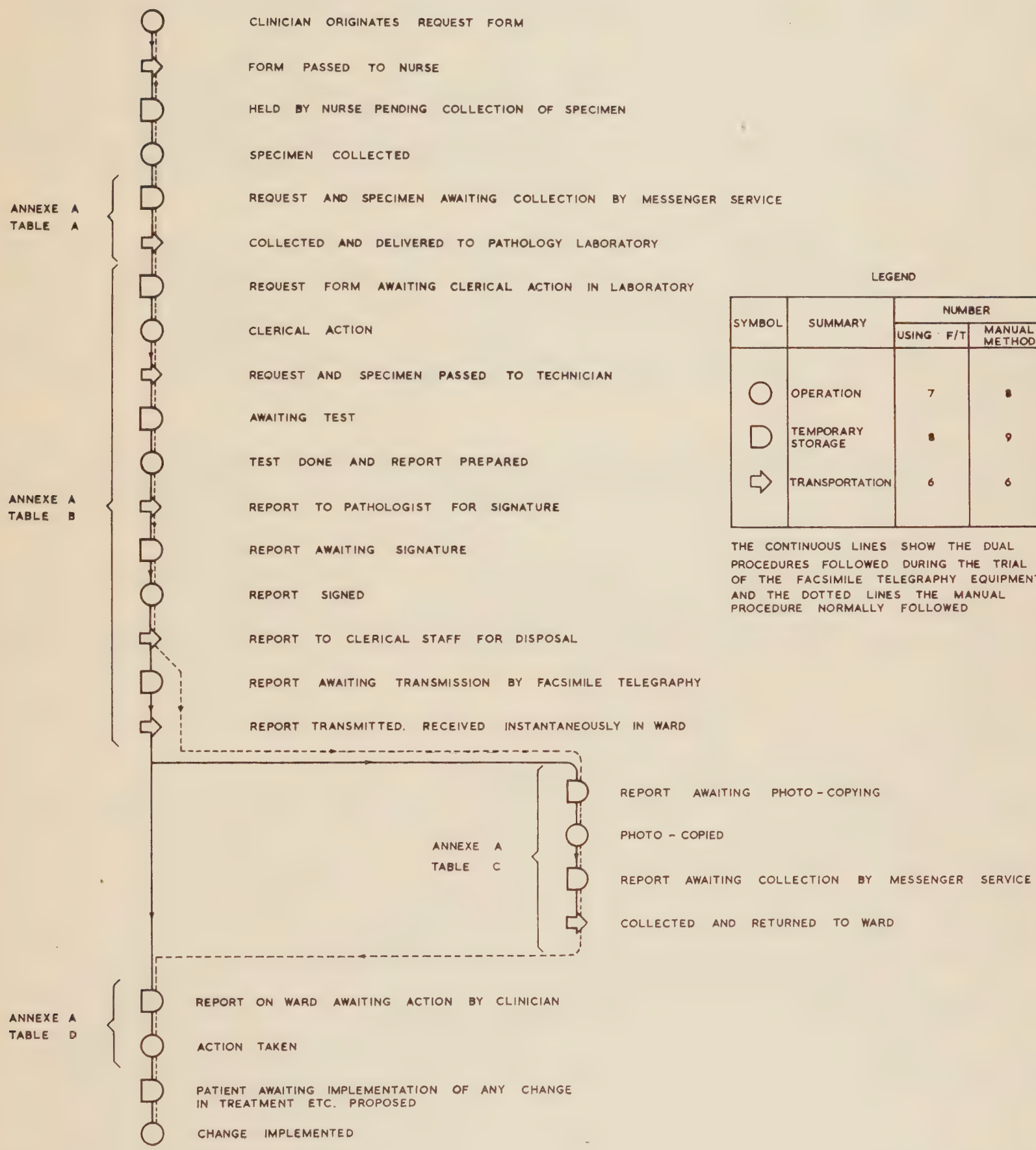
Elapsed time in hours	*Number of reports*
0–1	77
1–2	34
2–3	46
3–4	17
4–5	3
5–6	6
16–17	1*
17–18	8*
18–19	28*
19–20	22*
20–21	8*
21–22	2*
22–23	3*
23–24	11*
24–25	3*
26–27	1*
47–48	1†
48–49	6†

* These reports were received after the clinician's last routine daily visit to the ward and were not seen by him until the following day.

† These reports were received after the clinician's last routine visit to the ward on a Saturday and were not seen by him until the following Monday.

PROCEDURE FOR DEALING WITH PATHOLOGY REQUESTS AT ST. GILES' HOSPITAL

Annexe B
(Paragraph 7 of Appendix A)



LEGEND

SYMBOL	SUMMARY	NUMBER	
		USING F/T	MANUAL METHOD
○	OPERATION	7	8
D	TEMPORARY STORAGE	8	9
⇨	TRANSPORTATION	6	6

THE CONTINUOUS LINES SHOW THE DUAL PROCEDURES FOLLOWED DURING THE TRIAL OF THE FACSIMILE TELEGRAPHY EQUIPMENT AND THE DOTTED LINES THE MANUAL PROCEDURE NORMALLY FOLLOWED

Appendix B

(paragraph 7)

Trial use of F/T equipment for transmitting pathology reports between the Dulwich Hospital laboratory and Wards B1 and E1 of St. Francis' Hospital, East Dulwich

Conduct of trial

1. The trial took place between the laboratory and B1 and E1 wards which are geriatric medical wards for male and female patients respectively of 32 beds each. All requests received in the Dulwich Hospital pathology laboratory from the two selected wards during the period 27th November to 17th December, 1964 (both dates inclusive) were included in the trial. The grounds of the two hospitals are separated by a railway line under which is a connecting tunnel for foot traffic only. The distance between the Dulwich Hospital laboratory and the wards of St. Francis' Hospital via this tunnel varies between about 400 and 500 yards.

2. During the trial requests and specimens were conveyed between the wards and the laboratory in the usual way. This consisted of ward staff transferring daily all requests and specimens from the wards to a collecting point on F1 ward before 10.30 a.m., at which time the St. Francis' Hospital messenger made his single daily collection for direct delivery to the laboratory via the tunnel. On the few occasions when ward staff were unable to reach F1 in time for the collection they delivered direct to the laboratory.

3. A F/T transmitter was installed in the laboratory office and connected to a single receiver at the nurses' station on B1. All reports for B1 and E1 were transmitted over this link as soon as possible after they became available in the laboratory, and those for the latter ward were taken there by B1 ward staff as soon after receipt as possible. Copies of reports for B1 and E1 were also returned by the messenger service in the usual way, which was for the Dulwich Hospital messenger to collect the reports from the laboratory and deliver them to the Group offices in Dulwich Hospital and for the St. Francis' Hospital messenger to collect them from this point for distribution to the individual wards.

4. The hospitals' messenger services were scheduled to make the following daily visits to ward F1 of St. Francis' Hospital, the pathology laboratory and the Group offices (Saturdays and Sundays excepted) during the period of the trial:

(1) 10.30 a.m.: collect request forms and specimens from F1 and deliver to the laboratory.

(2) 10 a.m. and at hourly intervals thereafter (except 1 p.m.) until 5 p.m. with frequently a further collection as late as 5.30 p.m.: collect reports from laboratory and deliver to Group offices.

(3) 10.45 a.m. and 4 p.m.: collect reports from Group offices and deliver to the individual wards of St. Francis' Hospital.

5. Arrangements were made to record the following times in connection with the movement of request/report forms and F/T copies:

(1) When requests were originated (recorded by clinician).

(2) When request/report forms were available for collection in the wards by the hospital's messenger service (recorded by nursing staff).

(3) When request/report forms reached the laboratory (recorded by laboratory clerk).

(4) When F/T copies of reports were transmitted to ward B1 (recorded by laboratory clerk).

(5) When F/T copies of reports reached ward E1 (recorded by nursing staff).

(6) When F/T copies of reports were seen by the clinicians (recorded by clinician).

(7) When the copies of reports returned by the messenger services reached the Group offices and wards (recorded by Group office staff and nursing staff respectively).

A record was also kept by the laboratory clerk of the times of deliveries to and collections from the laboratory by the messenger services. A similar record was kept by Group office staff of deliveries to and collections from the Group offices.

6. The clinicians responsible were asked to classify the action taken on reports under one of the following headings which had been previously agreed:

(1) continue treatment unchanged;

(2) change treatment;

(3) further investigation;

(4) discharge patient;

(5) urgent reference to consultant or registrar;

(6) reference to consultant next visit.

Data provided by trial

7. The number of request/report forms originated in the two wards during the trial and other relevant data are set out below:

Total number of requests (haematology 35, bacteriology 46, chemical pathology 55 and histology 1)	137
Number of request/reports where all the data required for the trial were obtained	123
Number of cases where reports delivered by messenger arrived on wards after action had been taken by clinician on F/T copies	76 (61·8%)
Number of cases where reports delivered by messenger arrived on wards before action had been taken by clinician on F/T copies	47 (38·2%)
Average time delay between clinician acting on reports on which earlier action was possible and corresponding copies delivered by messenger service arriving on wards	17 hr. 43 min.

8. The following action was taken by the clinicians on the 123 reports for which all the required data were obtained, and on the 76 of these which were acted upon before the copies delivered by messenger service arrived:

Action by clinician	" 123 *reports* "	" 76 *reports* "
Continue treatment as before	66	41
Change treatment	43	26
Further investigation	7	4
Discharge patient	—	—
Urgent reference to consultant or registrar	—	—
Reference to consultant next visit	7	5

9. Tables showing the times that elapsed during the passage of the request/report forms through the main stages of the procedure appear in Annexe C. The flow chart in Annexe D shows the procedure for dealing with request/report forms followed during the trial and the procedure normally followed. It also identifies the tables in Annexe C with the part of the procedure to which they refer.

10. The laboratory's normal practice is to notify the results of urgent requests either by telephone or special messenger but this arrangement was suspended during the trial period in the case of B1 and E1 wards because of the availability of the F/T equipment. The clinicians asked for none of the requests made during the trial to be dealt with urgently. Two of the requests made, however, produced results which the laboratory staff considered required urgent notification to the wards.

11. During the period of the trial the messenger services between ward F1 of St. Francis' Hospital and the laboratory, and the laboratory and Group offices provided all the scheduled collections and deliveries. The messenger service between the Group offices and the St. Francis' Hospital wards missed four morning and two afternoon collections, and in addition two afternoon collections were made early (at 1.15 p.m. and 2 p.m. respectively).

Evaluation of data

12. The times of collections and deliveries by the messenger services and the failure to make all those scheduled influenced the results of the trial. This is demonstrated by the following further classification of the 76 reports where the copy delivered by messenger arrived after the clinician had seen the F/T copy:

(1) Fourteen of these reports were not taken from the laboratory by the next messenger collection after their transmission by F/T, although they must have been available.

(2) Forty-five were delayed because the messenger service from the Group offices to the wards either failed to make all the scheduled collections and deliveries or failed to make them to time. Included in this number are 11 of the 14 reports referred to in the sub-paragraph immediately above.

(3) Had the contingencies referred to in sub-paragraphs 12 (1) and (2) not occurred the number of F/T copies of reports on which earlier action was taken by the clinicians would have been reduced by 43, made up of 25 " continue treatment as before " cases, 14 " change treatment " cases, 2 " further investigation " cases and 2 " reference to consultant next visit " cases.

(4) During the Friday afternoons of the trial period a further 18 of these reports were transmitted by F/T too late for the copies delivered by messenger to reach the wards by the same day. Messenger services were not provided during the week-ends so that these reports did not reach the wards until the following Mondays. Provision of a Saturday morning messenger collection would have reduced the number of these reports which resulted in earlier action by using the F/T copies, e.g. a collection at 9 a.m. from the laboratory with direct

delivery to the wards would have reduced the number by 15, made up of 9 " continue treatment as before " cases, 4 " change treatment " cases, 1 " further investigation " case and 1 " reference to consultant next visit " case.

(5) The average time of arrival on the wards of the F/T copies of the other 10 of these reports, representing 8·1% of the total number for which full data was obtained, was 5 hours 59 minutes before those delivered by messenger.

13. The absence during the trial of a F/T receiver on Ward E1 and the consequent need to provide for messenger delivery of F/T copies of reports between B1 and E1 did not affect the results of the trial in any way, mainly due to the promptness with which they were transferred.

14. Only one of the two reports regarded as requiring urgent notification to the wards during the trial was transmitted using the F/T link and was seen by the clinician 66 hours before the arrival of the copy delivered by messenger —this lapse of time included a week-end period. In the other case the F/T equipment was not used and the laboratory technician concerned reverted to the normal practice of notifying by telephone. Copies of urgent reports transmitted by F/T will invariably reach the wards before those delivered by messenger although it does not necessarily follow, of course that they will be acted upon before the arrival of the latter.

Summary of results

15. The principal results produced by the trial are summarised below:

	Paragraph or Table (this Appendix)
(1) The use of F/T equipment made earlier action by clinicians possible on 76 of the 123 reports originated during the trial for which all the data required was obtained.	7
(2) On 46 of these 76 reports the clinicians either continued treatment as before or decided to refer to the consultant responsible next visit so that in only 30 cases did earlier notification result either in a change of treatment or further investigation.	8
(3) The messenger services failed to provide all the collections and deliveries scheduled, and reports were not always taken from the laboratory by the next messenger collection after their transmission by F/T. Had these omissions not occurred the number of reports on which earlier action by clinicians was possible would have been reduced by 43 (25 " continue treatment as before " cases, 14 " change treatment " cases, 2 " further investigation " cases and 2 " reference to consultant next visit " cases) from 76 to 33.	11 12 (1) 12 (2) 12 (3)
(4) Some reports were transmitted by F/T on the Friday afternoons during the trial too late for the copies delivered by messenger to reach the wards by the same day. As messenger services were not provided during the week-end periods these reports did not reach the wards until the following Mondays. Provision of a Saturday morning collection from the laboratory, say, at 9 a.m. with direct delivery to the wards would have reduced the number of F/T copies of reports which produced earlier action by a further 15 (9 " continue treatment as before " cases, 4 " change treatment " cases, 1 " further investigation " case and 1 " reference to consultant next visit " case).	12 (4)
(5) Only 10 of the 76 reports on which earlier action was possible were conveyed by the messenger service without being affected by one or more of the contingencies referred to in sub-paragraphs 15 (3) and (4) above. These 10 reports reached the wards an average of 4 hours and 50 minutes after the F/T copies.	12 (5)
(6) Only two of the requests originated during the trials produced results requiring urgent notification from the laboratory to the wards.	14
(7) The time that elapsed between the origination of request/report forms by clinicians and the specimens becoming available on the wards for delivery to the laboratory varied considerably during the trial. Periods of less than one hour to more than 239 hours were recorded.	Table A of Annexe C
(8) The time that elapsed between request/report forms and specimens becoming available for collection on the wards and their delivery by the hospital's messenger service to the laboratory in no case exceeded four hours during the trial and for 84% of those transmitted was less than one hour.	Table B of Annexe C
(9) The time that elapsed between the arrival of request/report forms at the laboratory and the transmission of completed reports by F/T equipment to ward B1 was less than 78 hours for 90% of the specimens tested in the Dulwich Hospital laboratory. The remainder were completed in periods varying between 90 and 173 hours. Periods between 218 and 339 hours	Table C of Annexe C

	Paragraph or Table (this Appendix)
were recorded for four requests referred from the Dulwich Hospital laboratory to the laboratory of King's College Hospital.	
(10) During the trial 30 F/T copies of reports for ward E1 were received on ward B1 and transferred to E1 by hand. In 26 cases this was done in under 45 minutes and in the remainder in less than 1 hour 45 minutes.	13 Table D of Annexe C
(11) The time that elapsed between the arrival on the wards of the F/T copies of reports and those delivered by the messenger services was less than 5 hours in 43% of the cases, between 5 and 24 hours in 32%, between 24 and 48 hours in 8·6% and between 65 and 69 hours in the remaining 16·4%. Most of the time in these cases was taken on the second stage of delivery between the Group offices and the wards.	Tables E (1) (2) and (3) of Annexe C
(12) The time that elapsed between the arrival on the wards of the F/T copies of reports and action being taken upon them by the clinicians was less than 7 hours in 30·7% of the cases, between 15 and 23 hours in 66·1% and between 44 and 47 hours in the remaining 3·2%.	Table F of Annexe C

Effect of substituting an hourly messenger service

16. If an hourly messenger service had been operated during the period of the trial with collections of completed reports from the pathology laboratory, say, at 9 a.m. and at hourly intervals thereafter until 5 p.m. on week-days and at 9 a.m. only on Saturdays with direct delivery to the wards, the result would have been a reduction in the number of cases where earlier action by clinicians of F/T copies was possible from 76 (61·8%) to 5 (4%), with action taken as follows:

Continue treatment as before	2
Change treatment	3

In making this assessment an average journey time of 15 minutes between the laboratory and wards B1 and E1 has been assumed. The distances involved are between 400 and 500 yards.

17. The following table provides a detailed analysis of the three reports (2·4%) referred to in paragraph 16 which resulted in a change of treatment:

Patient	*Ward*	*Action taken by clinician*	*Time F/T copies of reports acted upon by clinicians*		*Notional time of return by hourly messenger service*		*Delay between F/T copies being acted upon and notional time of return by hourly messenger service*
			Time	*Date*	*Time*	*Date*	
Patient A	B1	Change treatment	2.20 p.m.	4 12 64	3.15 p.m.	4 12 64	55 minutes
Patient B	E1	Change treatment	4.45 p.m.	22 12 64	5.15 p.m.	22 12 64	30 minutes
Patient C	B1	Change treatment	3 p.m.	18 12 64	3.15 p.m.	18 12 64	15 minutes

18. It was subsequently learned from the clinician concerned that in all three cases the change of treatment involved the prescribing of a different drug and that in all cases it proved beneficial. Reference to the relevant case notes showed that:

(1) Patient "A" was first given the new drug the day after the F/T copy of the report was acted upon by the clinician (time unknown).

(2) Patient " B " was first given the new drug on the same day as the F/T copy was acted upon (time also unknown).

(3) Patient " C " was written-up for a change of drug on 20th December, 1964, but it is not now certain that the change was directly attributable to the report seen two days previously.

Annexe C

(paragraph 9 of Appendix B)

Table A

Time that elapsed between origination of request/report forms by clinicians and specimens becoming available on wards for collection

Elapsed time in hours	*Number of request/report forms and specimens (Note 1)*
0–1	27
1–2	2
16–17	2
17–18	8
20–21	1
21–22	2
22–23	6
23–24	8
24–25	12
26–27	1
46–47	4
47–48	6 (5)
65–66	4
69–70	7 (7)
71–72	14 (13)
72–73	3 (3)
89–90	2
92–93	1 (1)
95–96	2 (2)
96–97	12 (12)
117–118	2 (2)
119–120	3 (3)
134–135	1 (1)
139–140	2 (2)
143–144	1 (1)
167–168	1 (1)
191–192	1 (1)
239–240	2 (2)

Note 1: The numbers of request/report forms for which the elapsed time included a week-end period are shown in brackets.

Table B

Time that elapsed between request/report forms and specimens becoming available on wards for collection and their arrival at the pathology laboratory

Elapsed time in hours	*Number of request/report forms and specimens*
0–1	115
1–2	13
2–3	7
3–4	2

Table C

Time that elapsed between the arrival of request/report forms at the pathology laboratory and the transmission of the completed reports to ward B1 by facsimile telegraphy equipment

Elapsed time in hours	*Number of reports*	*Type of test (Note 1)*			
		Bacteriology	*Chemical pathology*	*Haematology*	*Histology*
0–6	11	2	4	5	—
6–12	10	—	7	3	—
18–24	2	1	1	—	—
24–30	43	5	24	14	—
48–54	35	19	8	8	—
72–78	13	6 (6)	3 (2)	4 (4)	—
90–96	2	2 (2)	—	—	—
96–102	6	4 (4)	2 (2)	—	—
120–126	1	1 (1)	—	—	—
126–132	1	—	—	—	1
172–173	2	1 (1)	1 (1)	—	—
218–219	1	*1 (1)	—	—	—
286–287	1	*1 (1)	—	—	—
310–311	1	*1 (1)	—	—	—
338–339	1	*1 (1)	—	—	—

Note –: Only urgent requests were received by or returned from the pathology laboratory on the Saturdays and Sundays of the trial period. The numbers of reports where the elapsed times included a week-end are shown in brackets.

* The tests for these reports were carried out at King's College Hospital pathology laboratory. The elapsed times therefore include handling time in the pathology laboratories of both hospitals and transport time between them, as well as the time taken for the tests.

Table D

Time taken to deliver by hand to E1 ward F/T copies of reports received on B1 ward

Time taken in hours	*Number of reports*
0–$\frac{1}{4}$	9
$\frac{1}{4}$–$\frac{1}{2}$	10
$\frac{1}{2}$–$\frac{3}{4}$	7
$\frac{3}{4}$–1	1
1–1$\frac{1}{4}$	1
1$\frac{1}{2}$–1$\frac{3}{4}$	2

Table E (1)

Time that elapsed between the facsimile telegraphy copies of reports and the copies delivered by the hospitals' messenger services being received on the wards

Elapsed time in hours	*Number of reports (Note 1)*
1–2	9
2–3	17
3–4	11 (1)
4–5	18
17–18	2 (2)
18–19	4 (2)
19–20	1 (1)
20–21	20 (17)
21–22	4 (3)
23–24	10 (8)
24–25	1
25–26	2
26–27	2 (2)
27–28	3 (3)
40–41	1
47–48	2 (2)
65–66	*8
66–67	*10 (1)
68–69	* 3 (3)

Note 1: The numbers of reports delayed because the messenger services either failed to make all scheduled collections or failed to make them at the correct time, are shown in brackets.

* These reports were taken from the pathology department by the last messenger collection on Friday afternoon but were not delivered to the wards until the following Monday morning.

Table E (2)

Time that elapsed between the transmission of the F/T copies of reports to the wards and the delivery to the Group offices by the Dulwich Hospital messenger service of the conventional copies

Elapsed time in hours	*Number of reports*
0–1	64
1–2	49
2–3	13

Table E (3)

Time that elapsed between the arrival of the conventional reports in the Group offices and their delivery to the wards by the St. Francis' Hospital messenger service

Elapsed time in hours	*Number of reports*
0–1	3
1–2	19
2–3	19
3–4	15
4–5	2
16–17	4
18–19	3
19–20	21
21–22	8
22–23	1
23–24	2
25–26	5
46–47	2
65–66	9*
66–67	12*

* These reports were delivered to the Group offices on Friday afternoon but were not delivered to the wards until the following Monday morning.

Table F

Time that elapsed between receipt on wards of facsimile telegraphy copies of reports and action being taken on them by the clinician

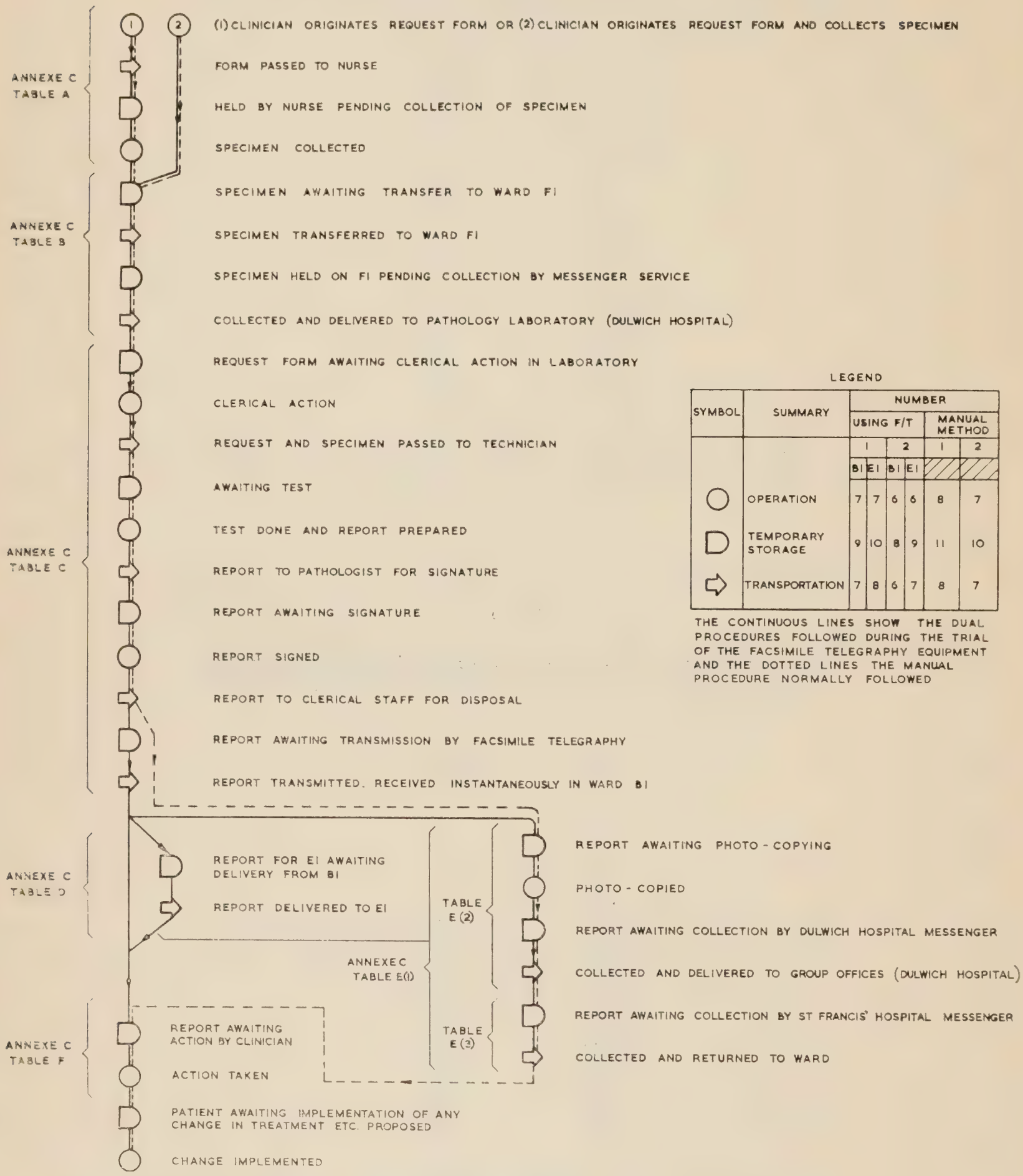
Elapsed time in hours	*Number of reports*
0–1	7
1–2	8
2–3	5
3–4	3
4–5	1
5–6	12
6–7	3
15–16	1*
16–17	1*
17–18	14*
18–19	3*
19–20	28*
20–21	8*
21–22	15*
22–23	14*
39–40	1†
44–45	2†
46–47	1†

* These reports were received after the clinician's last routine daily visit to the ward and were not seen by him until the following day.

† These reports were received after the clinician's last routine daily visit to the ward and were not seen by him until two days later.

PROCEDURE FOR DEALING WITH PATHOLOGY REQUESTS AT ST. FRANCIS' HOSPITAL

Annexe D
(Paragraph 9 of Appendix B)



LEGEND

SYMBOL	SUMMARY	NUMBER					
		USING F/T				MANUAL METHOD	
		1		2		1	2
		B1	E1	B1	E1		
○	OPERATION	7	7	6	6	8	7
D	TEMPORARY STORAGE	9	10	8	9	11	10
⇨	TRANSPORTATION	7	8	6	7	8	7

THE CONTINUOUS LINES SHOW THE DUAL PROCEDURES FOLLOWED DURING THE TRIAL OF THE FACSIMILE TELEGRAPHY EQUIPMENT AND THE DOTTED LINES THE MANUAL PROCEDURE NORMALLY FOLLOWED

Appendix C

(paragraph 11)

Comparative costs of F/T transmission and messenger delivery of pathology reports between the laboratory and 20 wards of a hospital

F/T transmission (by prepared document transmission equipment)*

Note 1 An amortising period of 10 years has been used to convert the capital cost of the installation to an annual revenue charge. This period was agreed with the manufacturer to represent a reasonable life expectancy for the equipment.

Note 2 Estimate based on information provided by the manufacturer.

Note 3 Estimate based on information provided by the Engineering Branch of the Ministry of Health. This charge would be saved if the internal telephone lines of a hospital were utilised.

Note 4 Estimated costs based on 50,000 in-patient reports per annum.

Capital costs of installations

Equipment	1 *transmitter and* 20 *receivers* (£)	2 *transmitters and* 20 *receivers* (£)	1 *transmitter and* 10 *receivers* (£)
Transmitter(s) at £898 each	898	1,796	898
Receivers at £756 each	15,120	15,120	7,560
Switching gear (estimated) (Note 2)	500	500	250
Wiring (estimated) (Note 3)	300	300	150
Total capital costs ..	16,818	17,716	8,858

Revenue costs per annum

Amortisation of capital cost (Note 1)	1,681	1,771	886
Interest at $5\frac{1}{2}$% (in 1964) on 50% of capital cost	462	487	244
Maintenance agreement (estimated) (Note 2)	550	575	290
Paper for receivers (Note 4)	133	133	133
Receiver marking blades (Note 4)	7	7	7
Fuel costs (estimated) (Notes 2 and 4)	14	15	8
Total annual revenue costs ..	2,847	2,988	1,568

Messenger delivery

It is assumed that deliveries are required at hourly intervals from 9 a.m. until 5 p.m. each week-day and until noon on Saturdays which represents 49 rounds weekly. On the basis of timings taken during the trials it is estimated that an average of $2\frac{1}{2}$ minutes would be required for each point visited, so that each round of 21 points would take $52\frac{1}{2}$ minutes.

Total weekly messenger time (49 × $52\frac{1}{2}$ minutes) 42 hours $52\frac{1}{2}$ minutes

Cost of a full-time porter, Class 1, based on London rates .. .. †£824

Total annual revenue cost of messenger service £883

* F/T equipment designed for manuscript communication and using suitably preprinted stationery could be used if (1) it was not a requirement that a two-part request/report form originated on the ward should be used, and (2) it was convenient for reports to be compiled and signed individually on the continuous stationery in the transmitter(s) in the pathology laboratory. The use of this type of equipment could be expected to reduce the total annual revenue costs shown above by about 25%.

† Cost for a 40-hour working week including employers' contributions in respect of superannuation, N.H.I. and Graduated Pension Scheme, plus an addition of 8% for sickness and annual leave replacements.

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